Validation Analyses of IEAF-2001 Activation Cross-Section Data for SS-316 and F82H Steels Irradiated in a White d-Li Neutron Field

Stanislav P. Simakov[1], Ulrich Fischer[1], Ulrich Moellendorff[1], Ingrid Schmuck[1], Haileyesus Tsige-Tamirat[1], Paul P. Wilson[2]

[1] *Forschungszentrum Karlsruhe*
[2] *University of Wisconsin-Madison*

A complete activation data library, the Intermediate Energy Activation File IEAF-2001 has been recently developed for applications to intermediate energy systems. It contains neutron-induced activation cross sections up to 150 MeV neutron energy for 679 target nuclides from hydrogen to polonium. Two different working libraries with 256 group data stored in different data formats have been derived for application calculations. One of them can be used by activation codes capable of handling an arbitrary number of reaction channels such as ALARA of the University of Madison-Wisconsin. The other one uses pseudo fission product yields to describe the generation of transmutation products and can be used with standard activations codes such as FISPACT of UKAEA Culham.

This paper presents IEAF-2001 validation analyses for SS-316 and F82H steels using results of activation experiments performed previously at the FZK cyclotron. Samples of SS-316 and F82H steels were activated in a white neutron field produced by a 40 MeV deuteron beam on a thick lithium target. The samples were exposed to a neutron fluence of $3\ 10^{15}$n/cm^2. The gamma-activities of 35 unstable nuclides in SS-316 and 22 in FH-82 were recorded at cooling times between 1 hour and 150 days.

For half of the measured radio-nuclides, the IEAF-2001 calculations agree with the measurements within the experimental uncertainty of typically 10-30%. This includes the main contributors to the total activity and the contact dose rate of the SS-316 and F82H steels, such as ^{56}Mn, ^{57}Ni, ^{58}Co, ^{54}Mn and ^{60}Co. For other radio-isotopes the calculation-to-experiment ratios varying between 0.03 and 5 were obtained. In particular this applies for activation reactions with reaction thresholds above 20 MeV such as ^{92}Mo(n,3na)^{86}Zr. It was also found that sequential charge particle reactions significantly contribute to the production of several radio-isotopes.

Email: simakov@irs.fzk.de